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G09F 9/30

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GB 2260844 A **GB 2257554 A** **EP 0898223 A1**
JP 100319879 A

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INT CL^7 **G02F 1/13 , G06F 1/16 , G09F 9/00 9/30 9/35 , H04M 1/02**
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(54) Abstract Title
Foldable electronic display device

(57) A foldable display device 10 comprises at least two display panels 11 electrically connected to form a continuous viewing area when in an open position. When closed the displays form a stacked configuration. The displays may be hinged together and the electrical connector may be a cable. The display device may be connected to an external device such as a mobile phone 20, a set top box, a VCR, a DVD player or the like. The display may also be integrated with such a device. A screen input means, such as a touch screen, may be provided.

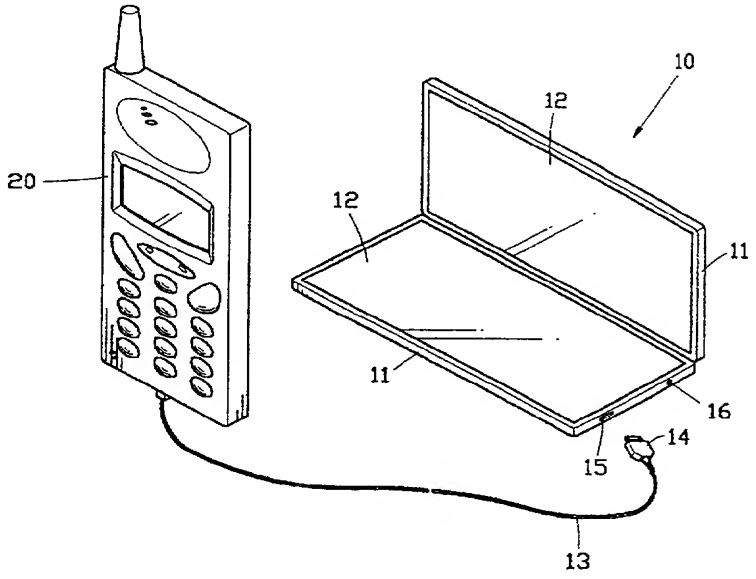

FIG.2

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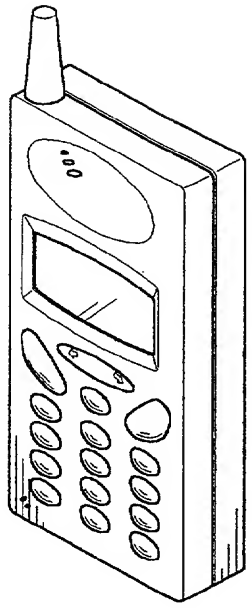
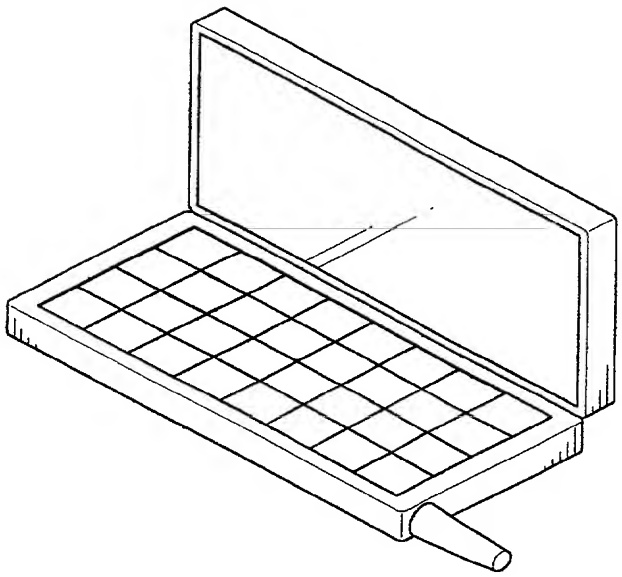


PRIOR ART

FIG.1A



PRIOR ART

FIG.1B

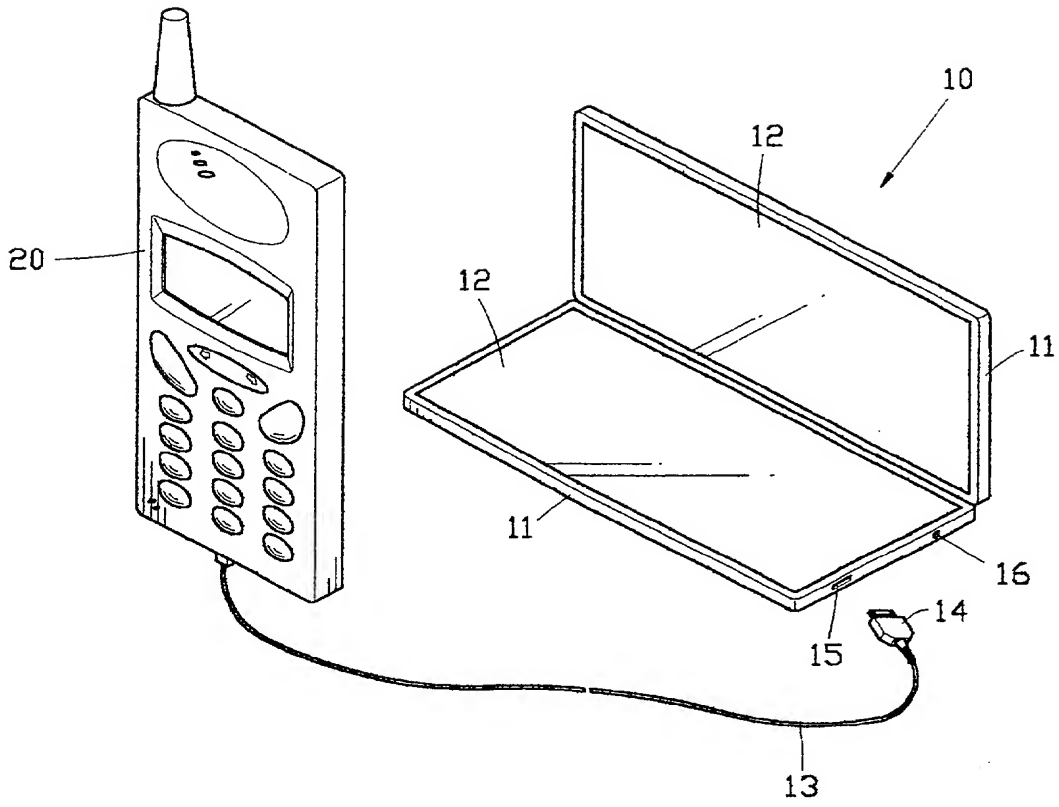


FIG.2

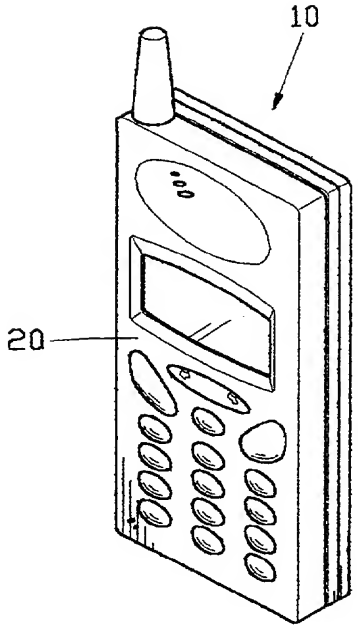


FIG.3

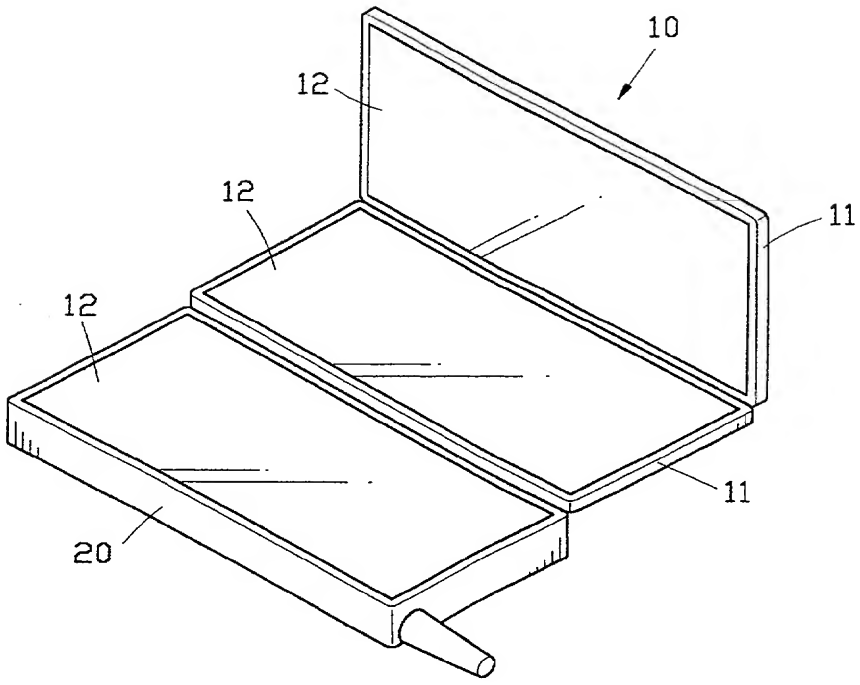


FIG.4

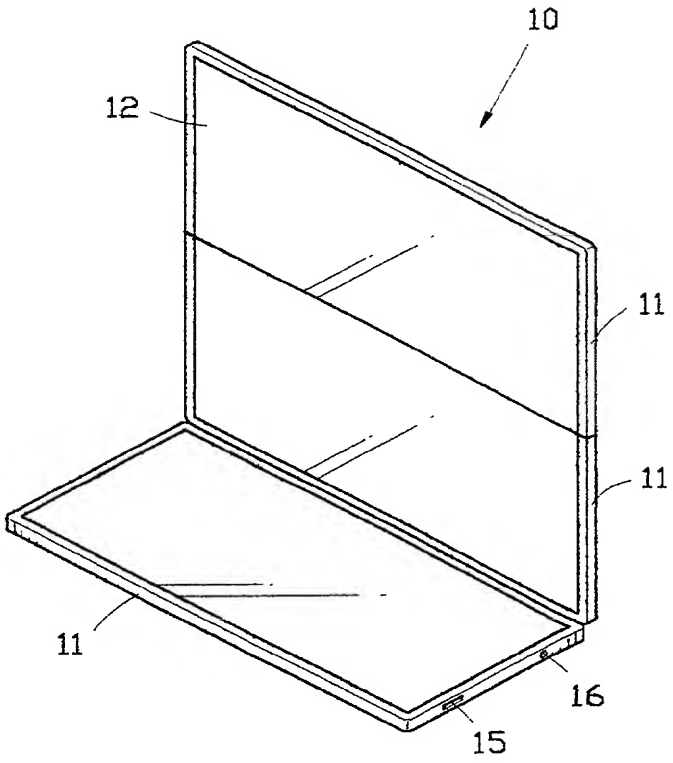


FIG.5

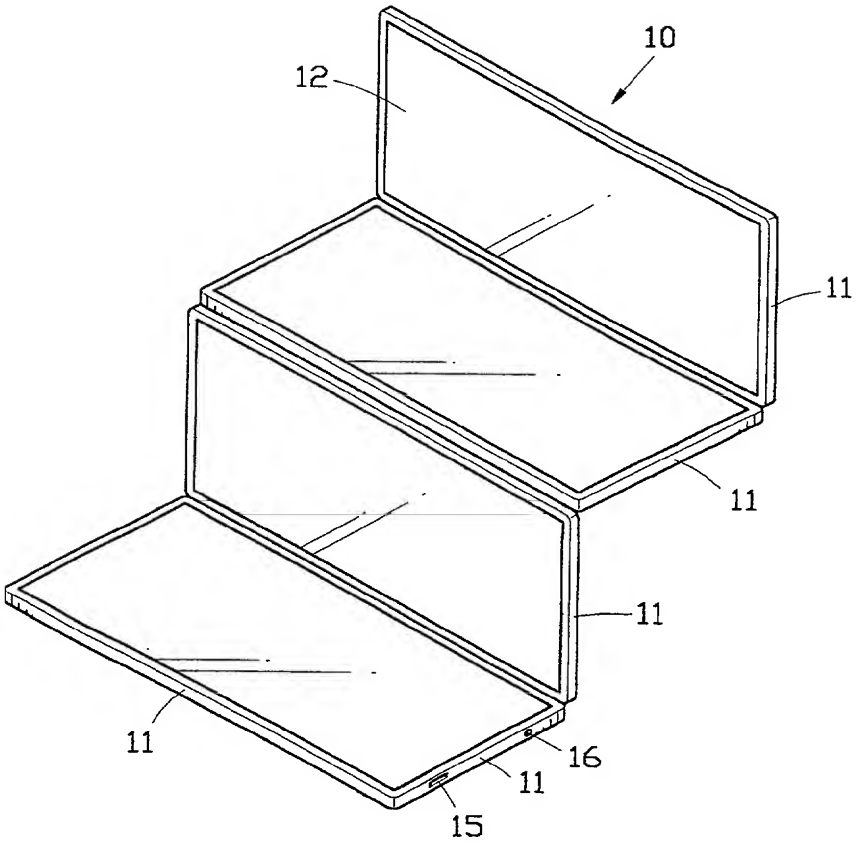


FIG.6

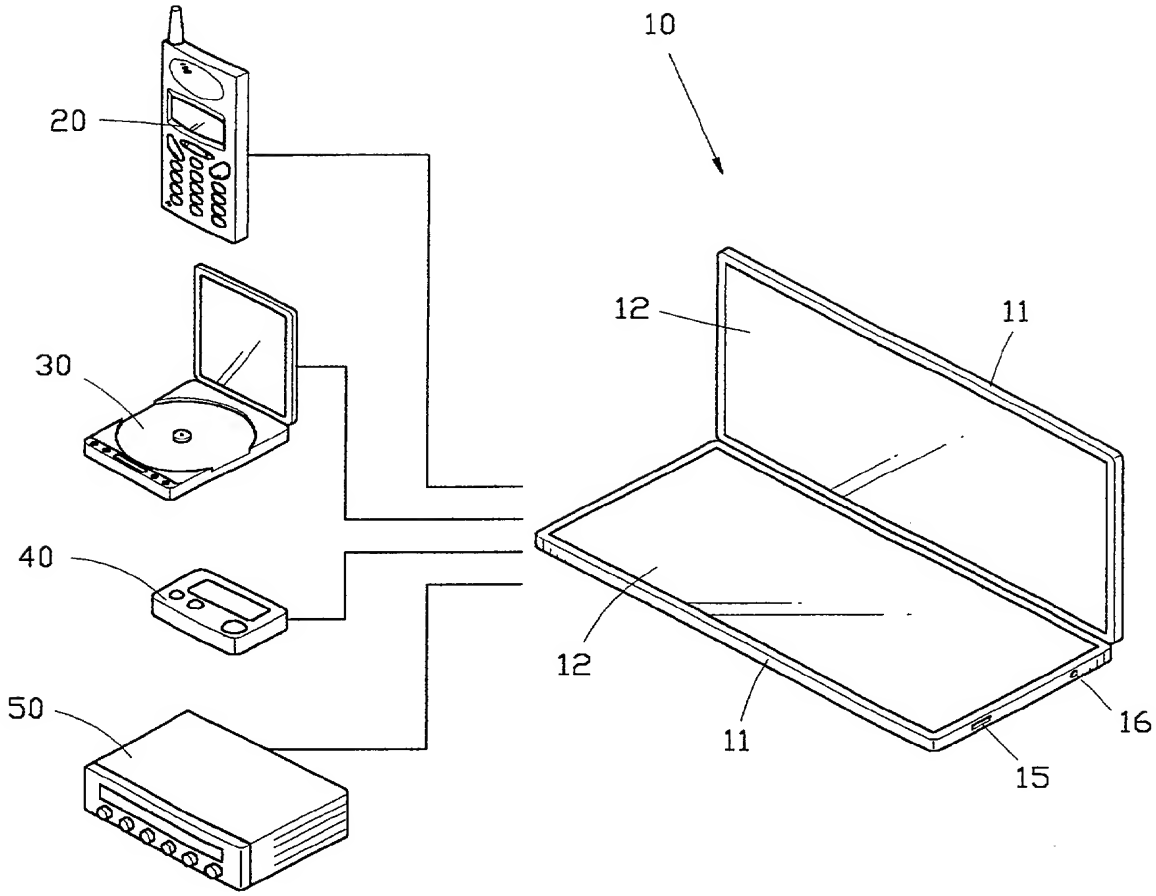


FIG.7

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FOLDABLE DISPLAY DEVICE

The present invention generally relates to a display device, and in particular to a foldable displaying device comprising a plurality of hinged display panels for displaying information or images electronically that are selectively expanded to form a large observing area or closed to overlap each other, forming a stack for reducing the amount of space they occupy.

Information appliances are prevailing due to the great amount of information we have today. Examples of the information appliances include notebook computer, personal digital assistant (PDA), and mobile phone. Video display devices, such as VCD, DVD player, MD player may also be included in the scope of the information appliances. These devices are usually equipped with a display for user's inspection of the information processed thereby. The current trend of these devices is to minimize the size and weight thereof. Reducing the size causes a reduction of the display, making it difficult for a user to read the information displayed thereon.

Figures 1A and 1B of the attached drawings show a mobile phone which incorporates a display. The display comprises a display panel hinged to the mobile phone whereby the display may overlap the mobile phone for reducing the amount of space occupied thereby when not in use. Such a displaying device comprises a single display panel and a single display panel provides a very limited viewing area. Thus, it is difficult for a user to efficiently inspect the information displayed thereby.

It is thus desirable to have a displaying device capable to provide a large viewing area as compared to the conventional device so as to overcome the above problems.

SUMMARY OF THE INVENTION

Accordingly, an object of the present invention is to provide a displaying device having a large viewing area while occupying a limited space when not in use.

Another object of the present invention is to provide a displaying device which is capable to be connected to an external device for displaying information received therefrom.

A further object of the present invention is to provide a displaying device incorporating built-in application software to serve as input means whereby conventional input devices, such as keyboard, may be eliminated.

To achieve the above objects, in accordance with the present invention, there is provided a foldable displaying device comprising at least two thin plate-like display panels each having a display surface. The display panels are electrically and mechanically connected to each other whereby the display panels are movable between a closed position where the display panels overlap each other to form a stack and an open position where the display surfaces form a continuous viewing area. The displaying device may be connected to an external device, such as a mobile phone, a set top box, a VCD, a DVD player or an MD player for providing a user with a large observation area. The displaying device may be separated from the external device or alternatively, the displaying device may be integrated with the external device. Application software may be incorporated in the displaying device for providing a screen input

means, such as touch screen technique, whereby conventional input devices, such as a keyboard, may be eliminated.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be apparent to those skilled in the art by reading the following description of preferred embodiments thereof, with reference to the accompanying drawings, in which:

Figures 1A and 1B are perspective views respectively showing a conventional displaying device connected to a mobile phone at a closed position and an open position;

Figure 2 is a perspective view showing a displaying device in accordance with a first embodiment of the present invention to be connected to a mobile phone via a cable;

Figure 3 is a perspective view showing a displaying device in accordance with a second embodiment of the present invention connected to a mobile phone at a closed position;

Figure 4 is a perspective view showing the displaying device of the second embodiment at an open position;

Figure 5 is a perspective view showing a displaying device in accordance with a third embodiment of the present invention at an open position;

Figure 6 is a perspective view showing a displaying device in accordance with a fourth embodiment of the present invention at an open position; and

Figure 7 is a schematic view illustrating that the displaying device of the present invention may be connected to a variety of external devices.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

With reference to the drawings and in particular to Figure 2, wherein a foldable displaying device constructed in accordance with a first embodiment of the present invention, generally designated by reference numeral 10, is shown, together with a mobile phone 20 to which the displaying device 10 may be connected via a cable 13 to serve as an extended display of the mobile phone 20, the displaying device 10 comprises at least two display panels 11 which are in the form of thin plate, preferably rectangular plate. Each display panel 11 has a display surface 12 and an opposite back surface (not labeled).

The display panels 11 are connected to each other by means of hinge arranged along sides thereof whereby the panels 11 are movable with respect to each other between a closed position where the display panels 11 overlap each other with the display surfaces 12 thereof confronting each other and an open position where the display surfaces 12 are exposed to form a continuous viewing area for visual observation as shown in Figure 2.

Electrical connection is formed between the display panels 11 by any known means, such as a flat cable. At least one of the display panels 11 forms a signal connector 15 for mating a cable end connector 14 of the cable 13 to establish electrical connection between the display panels 11 and the mobile phone 20. A power connector 16 is formed in one of the display panels 11 for connection with an external power source. The displaying device 10 may be powered by either the mobile phone 20 or the external power source.

Also referring to Figure 7, quite apparently, besides a mobile phone 20, the displaying device 10 may be connected to other communication

device, such as a pager 40, an information appliance, such as a set top box 50, or an image display host device 30, such as a VCD, a DVD player or an MD player.

The displaying device 10 allows a user to obtain a twice large viewing area by expanding the display panels 11 to the open position, while reducing the amount of space required for storage of a non-used displaying device by closing the display panels 11.

Figures 3 and 4 show a second embodiment of the present invention. The displaying device 10 is hinged to and electrically connected to the mobile phone 20 whereby the display panels 11 may overlap and thus be stacked over a back side of the mobile phone 20. Preferably, the back side of the mobile phone 20 is also formed with a display panel whereby once expanded, a three times large viewing area may be obtained.

Figure 5 shows a third embodiment of the present invention. The foldable displaying device 10 of the third embodiment of the present invention comprises three display panels 11 of which one forms a power connector 16 for connection with an external power source and a signal connector 15 for connection with an external device, such as a mobile phone, a VCD, a DVD player and a set top box. The three display panels 11 are hinged side by side to form a three fold structure. Each display panel 11 has a display surface 12. The display panels 11 are connected so that they are movable between an open position where the display surfaces 12 form a continuous viewing area and a closed position where the display panels 11 overlap each other as a stack. The displaying device 10 of the third embodiment provides a three times large viewing area as compared to a single display panel.

Figure 6 shows a fourth embodiment of the displaying device 10 in accordance with the present invention. The displaying device 10 of the

fourth embodiment is similar to the third embodiment discussed with reference to Figure 5 except that the fourth embodiment comprises four display panels 11, each having a display surface 12, hinged to each other side by side whereby the display panels 11 are movable between an open position where the display surfaces 12 form a continuous viewing area that is four times that of a single display panel 11 and a closed position where the display panels 11 overlap each other as a stack.

Besides simply displaying signal transmitted thereto from an external device, such as mobile phone, the displaying device 10 may incorporate suitable software therein for providing an input means thereof, such as using a touch screen, together with application software, to serve as the input means. This allows a reduction in the amount of space occupied by the displaying device 10.

CLAIMS

1. A foldable display device comprising at least two thin plate-like display panels each having a display surface forming electrical connection with each other, the display panels being movably connected to each other whereby the display panels are movable with respect to each other between an open position where the display surfaces form a substantially continuous viewing area and a closed position where the display panels overlap each other to form a stack, signal receiving means being formed in at least one of the display panels for receiving signals from an external signal source and displaying the signal on the display surfaces.

2. A foldable display device according to claim 1, wherein power receiving means is formed in at least one of the display panels for receiving power from an external power source.

3. A foldable display device according to claim 1 or claim 2, wherein the electrical connection between the display panels is formed by a cable.

4. A foldable display device according to claim 1, claim 2 or claim 3, wherein the display panels are hinged to each other in a side by side fashion.

5. A foldable display device according to any one of the preceding claims, wherein the displaying device comprises at least two display panels hinged to each other, one of the display panels further hinged to an external device.

6. A foldable display device according to any one of the preceding claims, wherein the displaying device comprises three display panels hinged to each other in a side by side fashion.

7. A foldable display device according to any one of the preceding claims, wherein the displaying device comprises four display panels hinged to each other in a side by side fashion.

8. A foldable display device according to any one of the preceding claims, wherein a touch screen is formed on at least one of the display panels, which cooperates with application software built-in the displaying device to serve as an input means.

9. Foldable display devices substantially as herein described with reference to and as illustrated in Figs. 2 to 7.

Application No: GB 0006967.4 **Examiner:** Rowland Hunt
Claims searched: All **Date of search:** 21 June 2000

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.R): G5C (CHA, CHC, CHD)

Int Cl (Ed.7): G02F 1/13; G06F 1/16; G09F 9/00, 9/30, 9/35; H04M 1/02

Other: Online: EPODOC, JAPIO, WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB 2260844 A	(SONY) see whole document, particularly, fig. 4 and page 4, lines 8-11.	1, 2, 4
X	GB 2257554 A	(D'OYLY) see whole document.	1, 3, 4
X	EP 0898223 A1	(LUCENT) see whole document, particularly figs. 4 and 6 and col. 2, line 49 to col. 3, line 6.	1, 3-8
X	JP 10-319879 A	(KUJIRATA) see abstracts and figs.	1, 3-8

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